The Hungarian Technology Foresight Programme

TRANSPORT

Panel Report

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In 1998 the National Committee for Technological Development (OMFB) launched a technology foresight programme named TEP after its Hungarian acronym. The main objective of the programme was to make a contribution to improving the long-term competitiveness of the country's economy. This would enable new opportunities to be identified in the development of both the market and technology that would improve the quality of life of the population. By analysing major changes in the economy and society as well as new achievements in science and technology, TEP defines the key issues and the areas where strategic decisions need to be made that will be crucial for the country's development in the next 15-25 years.

The Steering Group and the thematic panels have assessed the current situation, outlined different scenarios for the future, and formulated their recommendations with a view to bringing about the most favourable of these.

The thematic panels analysed the key aspects of the following, closely interrelated areas:

- Human resources (education and employment)
- Health and life sciences
- Information technology, telecommunications and the media
- Protection and development of the natural and built environment
- Manufacturing and business processes
- Agribusiness and food industry
- Transport

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Introduction

The objective of this report is to present possible future scenarios for the transport sector, which are coherent with the macro-economic visions of the country, and to formulate recommendations facilitating the achievement of the most realistic scenario.

The most unpredictable phenomena in this context are shifts in technology, breakthroughs in innovation and sharp changes in development. We have therefore also used the 'countdown' approach (reflexive method) to approximate the course of development from the final, presumed state. This was used in conjunction to the linear development model that extrapolates today's trends. It was necessary to change certain aspects and intervene in the areas where the trends resulting from the two approaches varied significantly.

A snapshot

Economic role of the sector

The ratio of freight transport to GDP amounted to around 6-7 per cent before the start of the transition to a market economy. It suffered a slight decrease during the economic transition, subsequently stabilising at 6 per cent. (The EU average is approximately 4 per cent).

In the 1990s the total output (performance) of the Hungarian transport system was in decline. Passenger transport (in passenger kilometres) fell by 11 per cent, which was less than the drop in GDP (20 per cent), with freight transport, however, suffering a drastic loss.[1] The sector has undergone a consolidation process in recent years and a slight growth may even be observed. (Table 1) This is due primarily to the fact that the positive changes in the industrial structure of the country have led to an increase in the role of cooperative company networks, resulting in the transport of goods of a lesser load-weight but of more value-added content.

Table 1. Volume and share of sub-sectors in passenger transport

	1990	**1995**	**1996**	**1997**	**1998**
Total (billion person-kilometres)	93.30	85.68	86.26	86.46	86.66
Changes (per cent, 1990=100)	*10.00*	*9.83*	*92.45*	*92.67*	*92.88*
Railways (%)	12.22	9.85	9.95	10.03	10.24
Public roads (%)	85.92	87.31	86.80	86.40	86.20
Water transport (%)	0.05	0.06	0.05	0.05	0.05
Air transport (%)	1.81	2.78	3.21	3.53	3.51
Total (per cent)	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***

Source: Ministry of Transport, Telecommunications and Water Management, Hungary

The market share of the different transport sub-sectors has also changed. The role of the railway is decreasing in passenger transport, with public road transport becoming more dominant (Table

[1] The volume of freight transport (in ton kilometres) declined by one-third in the given period.

2). Passenger transport on the waterways is marginal while the role of air transport is showing a dynamic increase. The proportion of individual (personal) transport is gaining market share over public transport.

With regard to freight haulage the share of public road transport has grown and that of the railway has stabilised at a lower level. Hungarian marine shipping is disappearing and the significance of the country's waterways in transport has also declined slightly. The role of pipelines has increased and the share of freight transport by air is marginal in Hungary.[2]

Table 2 Volume and share of sub-sectors in freight transport

Year	1990	1995	1996	1997	1998
Total (billion ton kilometres)	51.93	28.40	28.74	29.46	30.61
Changes (per cent, 1990=100)	100.00	54.64	55.29	56.66	58.94
Railways (per cent)	32.31	29.65	26.55	27.66	26.62
Public roads (per cent)	29.23	49.89	51.22	50.88	52.24
Waterways (per cent)	28.23*	6.51	6.33	5.94	5.33
Air transport (per cent)	0.04	0.14	0.14	0.17	0.12
Pipelines (per cent)	10.19	13.81	15.76	15.35	15.68
Total (per cent)	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***

* In 1990 marine shipping still played a relatively significant role in freight transport.
Source: Ministry of Transport, Telecommunications and Water Management

The fundamental changes in the political and economic system caused significant changes in the ownership structures of transport companies. By 1998 the share of state ownership, calculated on the basis of registered capital, had dropped to 54.3 per cent. The remaining area is either in municipal ownership (30.5 per cent) or in private hands (15.2 per cent), with the role of foreign ownership increasing within the latter structure (in 1998 foreign ownership represented a 3.8 per cent share of the whole transport sector). Foreign direct investments have played a relatively strong role in motorway construction.

Privatisation has prompted competition in the different transport sub-sectors, for example in public road transport. In other areas such as railways, waterways, air transport and public passenger transport the dominance of state (community) ownership and provision of services has been preserved (in many cases up to a level of 100 per cent).

State of the transport sub-sectors (branches)

Railway transport

Two companies currently operate in the railway sub-sector in Hungary. The Hungarian Railway Company (MÁV after its Hungarian acronym) has been operating since 1993 as a 100 per cent state-owned public company. Within this company two divisions have been established with separate accounting systems: railway track maintenance, and business operations. The economic activities that were not closely connected to the basic services provided by the company were

[2] These indicators differ significantly from those of the developed European countries: there the market share of railway transport is smaller (some 14 per cent) than in Hungary, while that of public roads is higher (some 74 per cent). Inland waterways have a 7 per cent share while pipelines account for 5 per cent of the total transport market.

reorganised into independent business entities in the early 1990s. The other Hungarian railway company, Győr-Sopron-Eberfurt Railway Company (GYSEV), is majority owned by the state and is operated on a concession basis. GYSEV's other major owner is the Austrian state and a minority of the company's shares are in the hands of private investors. GYSEV's operation is 'undivided' in that infrastructure and business management have not been separated into different divisions within the company.
MÁV's productivity (in ton kilometres per employee) amounts to slightly more than half of the average level of the EU countries. This low performance may be primarily attributed to the poor infrastructure and the obsolete technical level of vehicles and equipment.

Public road transport
The freight transport segment of the sector is entirely privatised. The number of business units operating in this market segment grew from 1,370 to 3203 in the four-year period between 1994 and 1998. 80 per cent of the shipping companies employed less than 10 persons in 1998, with only 77 employing more than 50 persons and four having more than 300 employees. Market competition is very strong in this field. Annually-defined entry and transit quotas and severe environmental and financial regulations have had a negative effect on the competitiveness of domestic freight carriers. The public road public transport is characterised by low profitability. State-owned 'Volán' companies provide the majority of services, with a few private companies also operating in the field. The local government-operated urban public transport is not profitable.

Water transport
Although declining demand for inland water transport is a general tendency across Europe, it became especially severe in Hungary after the start of the transition. The drastic drop may be explained in part by the structural changes in the economy but its occurrence was also due to weaknesses in competitiveness primarily caused by poor infrastructure.[3]

Although Mahart (the Hungarian Water Transport Company) is owned by the state, direct state support for the company has ceased. The company's marine shipping operation played a significant role before the start of the transition, but its former markets were lost after the reorganisation and the marine operations suffered losses. No business has been registered in marine shipping services since 1994 and ships have either been sold or contracted out.

Air transport
The Hungarian Airways Company, Malév, has again been taken over by the Hungarian state following an earlier effort at privatisation. The owner's main goal is financially to reorganise the company and prepare it for a beneficial privatisation. The privatisation strategy is currently being formulated.

Air transport and airport services are the most successful area of the Hungarian transport market (in terms of increasing turnover). Malév's competitiveness has still to be improved despite its position as a leading airline company within the Central and Eastern European region. Malév's share of the European market constitutes 0.3 per cent. However, even this position may be endangered by the anticipated liberalisation of the international markets. There is still no regular

[3] The main problems are posed by the deficiencies in quality of the waterways, the underdeveloped network of harbours and obsolete ships and equipment.

air transport service within the country but several private companies offer casual domestic air transport services.

Combined transport

The negative environmental impacts of public road transport, traffic jams and the under-used railway and waterway transport capacities have lead to the emergence of combined transport forms on an international basis. In 1996 combined transport accounted for only 0.5 per cent of the total volume in Hungary. The situation was better in the international transport segment: combined transport accounted for 5.8 per cent of the export-import volumes transported by railway and public roads, with the share in transit transport being 6.2 per cent. (The planned development of logistics centres in the country will probably lead to increases in the above levels). With regard to the competitiveness of combined transport, the deficiencies in the infrastructure and heavy traffic in the vicinity of lorry terminals constitute the most significant weaknesses.

Logistics centres

The need for logistics centres in Hungary emerged after the political and economic changes of 1990. Feasibility studies identified ten potentially suitable regions that would enable integration into the European network of logistic centres on the basis of their geographical location and other aspects. Based on preliminary demand estimates the establishment of only 3 or 4 centres appears to be justified. Several logistics centres are already under construction in the country, although none are yet operating at full capacity.

The establishment of domestic logistics centres is being hampered by the large amount of financial investment required and the long-term return. Potential foreign investors ready to build logistics centres in the country under concession contracts have certain general pre-requisites with regard to the availability of a well-developed infrastructure. The development of this infrastructure, however, requires considerable central or local public investment. Public contribution is justified in certain cases, such as for the establishment of logistics centres at the junctions of transport corridors (e.g. the logistics centre under construction in Záhony on the Ukrainian-Hungarian border).

Pipelines

This form of transport is playing an important and gradually increasing role in freight delivery in Hungary. By its very nature, however, it is limited to specific goods. 40 per cent of the total volume of pipeline deliveries in 1998 comprised oil, 49 per cent was gas and 11 per cent comprised other hydrocarbons.

Employment, education and training

The decline of the economy's transport needs and the restructuring among and within different areas of transport has lead to changes in employment demand. The number of employees has been dropping during the past decade in relation to the total sector and most transport sub-sectors. The reduction of employees was particularly high in railway and water transport whilst a

remarkable parallel increase was apparent in transport service jobs (e.g. shipping and logistics operations).

The productivity of the Hungarian railway transport sub-sector (expressed in ton kilometres per employee) amounts to around 60 per cent of the average EU productivity level. Productivity in the Hungarian air transport area (in passenger kilometres per employee) is close to that of the EU average.

The 1998/1999 school year produced 231 students graduating from secondary vocational education with a specialisation in transport. This number does not even equate to 1 per cent of the total number graduating from secondary vocational schools. 1024 students in total were registered in vocational transport schools in 1998, which is less than 1 per cent of the total. Within Hungarian higher education, two institutions provide specialised education in transport: the Technical and Economic University of Budapest (at the Schools of Transport Engineering) and István Széchenyi College at Győr. Just under 1300 students were studying at the School of Transport Engineering of TEUB in 1998, constituting 6.4 per cent of the total number of students studying at technical universities in Hungary.

Research and Development (R&D)

The majority of infrastructure research, including transport, comes under the sphere of responsibility of local/state government. One consequence of this is that the majority of results in the field are not just applied and exploited by one manufacturer or service provider, but on a societal level across the economy. It is therefore quite natural for such research work to be financed primarily by the state (or local communities).

Expenditure on R&D has suffered a continuous decrease during the past decade. Applied research has declined within this trend, especially in the field of transport. In terms of the total research and development expenditure of the country (GERD), the fields belonging to the Ministry of Transport, Telecommunications and Water Management (MTTW) represented a 3.6 per cent share in 1990, which decreased to 1.3 by 1995. (These figures include research and development expenditure in the fields of telecommunications and water management. Transport represents approximately half of the allocated R&D spending).

The ongoing and substantial decline of financial resources has resulted in the number of the employed in transport research and development decreasing by two-thirds over the past decade. Among the transport research institutes working directly in the field, the two most important knowledge bases are the Transport Research Institute (150 employees) and the Research and Development Institute of MÁV (30 persons). There are a small number of transport service and consultancy companies in the country that carry out private research and development work. Transport companies do not carry out R&D activities. With regard to higher education institutions, the above two institutes are engaged in applied research in the fields of transport management and engineering.

State of the transport sector and social impacts of transport

Infrastructure

The Hungarian transport infrastructure is 'two-sided': its network is developing and involving an increasing level of up-to-date technology. However, the infrastructure is in a poor condition and the equipment is obsolete in almost every area of the transport sector, particularly railway and water transport. The problems are exacerbated by the fact that that there are no adequately prepared transport development projects that would attract the financial resources of foreign investors or EU funds into the country.

The total length of public railway tracks with standard gauges is 7,657 kilometres and relative indicators reveal that the density of railway tracks in the country is high.[4] 33.9 per cent of railway tracks are electrified (the EU average is 47 per cent) and the proportion of two-track sections is 16.9 per cent. Only slightly more than 35 per cent of railway tracks permit a speed of 100 kilometres per hour whilst the length of sections suitable for the elevated speed of 160 kilometres per hour is insignificant. Hungarian railway locomotives are obsolete and are reminiscent of a technical level of 20-30 years ago. The proportion of electric traction has reached 70 per cent.

The total length of Hungarian roads in 1998 was 187,431 kilometres. 51,979 kilometres of these were private roads and 135,452 kilometres were public roads. The length and territorial density of Hungarian roads are in line with the EU average. The distribution pattern of the country's public roads is characterised by a radiating structure with Budapest at the centre, and it is inadequate for meeting the transport needs of the country's regions. The country's public roads are being developed on a continuous basis. The length of motorways and trunk roads (which accounted for 498 kilometres in 1998) is inadequate even in terms of current transport needs let alone the future ones. The relative length (kilometres per capita) of motorways in Hungary only comprises a quarter of the EU average. The construction of express roads has been accelerated since 1998 but was primarily limited to the extension of existing roads and the development has not affected the construction of axial roads connecting the regions. The ten-year public road development programme that was passed in 1999 puts a special emphasis on regional needs and the effects on the local economies along with the objective of accessing the pan-European transport corridors. The main transport corridors in Hungary have been developed through combined financing and primarily under concession contracts that mobilised considerable state resources and foreign investments. The resources for future development are apparently to be provided by the state budget and state-guaranteed loans. (It is also a goal to obtain EU support for domestic public road development). The state resources are composed of budgetary financial resources and the so-called 'road funds' accumulated from fuel sales taxes. A toll system has been introduced on motorways built under concessions and on state-constructed motorways road usage is paid for by the purchase of stickers. Local roads are owned by the municipalities and their development, maintenance and operation come under the responsibility of the relevant municipalities. (The state contributes to the above costs through competitive support schemes). Nine thousand kilometres of roads were built on the initiative of local governments during the period between

[4] 81.8 kilometres per 1000 square kilometres and 0.74 kilometres per 1000 inhabitants

1989 and 1997. The public transport vehicle fleet has undergone considerable quantitative and qualitative improvements over the past decade. The present relative indicator of Hungary is approximately 250 passenger cars per 1000 inhabitants, which approximates half the EU average and correctly reflects the country's level of economic development. The number of registered motor vehicles in the country was close to 2.7 million in 1998, equating to an increase of around 300,000 vehicles since 1990. 83 per cent of these were passenger cars, 12.7 per cent were HGVs, 3.6 per cent were motorcycles and 0.7 per cent were buses. The composition of the motor vehicle fleet has shown considerable improvement but this process has also been accompanied by a continuous increase in the average age of the vehicles.

In 1998 the length of waterways suitable for navigation in Hungary was 1622 kilometres, 249 kilometres (15.3 per cent) of which were usable only on a periodic basis. The decline of Hungarian water transport may essentially be attributed to the poor and even deteriorating conditions of the country's waterways, in both absolute and relative terms. The inadequate development and maintenance of the waterways and the unresolved problems of the Bős-Nagymaros hydropower plant has meant that the Hungarian part of the Danube is non-navigable during one-third of the year and only navigable to a limited extent during an additional four-month period of each year. The Tisza and Dráva rivers also constitute major waterways of the country but their shipping traffic is insignificant. The river ports of the country are underdeveloped and there are 'missing links' in the network. They also often lack the necessary equipment and use obsolete technologies. The situation is exacerbated by the lack of appropriate connections to land transport lines (public roads and railways). Furthermore, the fleet of ships is shrinking on a continuous basis and the technical level becoming obsolete.

The international airport of Ferihegy is owned by the state. It is up to date in terms of its technical level and its capacity is increasing on a continuous basis due to systematic development. (The airport received 5.5 million passengers in 2000.) A new, integrated control system meeting the strictest European norms has been installed at the airport to upgrade air traffic control. Investments and development efforts have meant that the airport is able to cope successfully with the increasing transport demand. Malév, the Hungarian airline company, has almost entirely renewed its fleet of aircraft over the past decade. The obsolete, ageing aeroplanes have been replaced by more up-to-date aircraft which use relatively less fuel. The number of private aeroplanes and helicopters is continuously on the rise, but their share in air transport is not yet significant.

There are a total of 18 public road/railway combined transport terminals operating in Hungary at present, but only three are used to their full capacity.

In 1998 the total length of pipelines in the country amounted to 7,201 kilometres and the last decade has seen continuous growth in this respect. (In 1994, for example, the total length of domestic pipelines was 6,700 kilometres). The pipelines are managed and operated by their owners.

Transport policy and the regulatory system

Hungary's transport policy defines five, equally important priorities: 1) facilitating integration into the European Union; 2) fostering cooperation with the neighbouring countries; 3) facilitating balanced regional development within the country; 4) protecting human lives and the environment; 5) establishing an efficient, market-based transport regulation system.

The main pre-requisite for our integration into the European Union is represented by the development of the country's transport infrastructure along the main transit routes, meeting both capacity and service quality requirements. The goal of the regulatory system is to create an environment that fosters market competition. One of the market means is the introduction of a new tariff system that would put more emphasis on gradually 'absorbing' external costs as well as including the cost of infrastructure in transport service prices.

The transport policy has the objective of decreasing the role of the state to a minimal level wherever commercially and socially possible. In a parallel move, efforts should be made to implement partial privatisation of companies, with majority state ownership thereby increasing capital assets and making company management more cost-sensitive. In the long term the scope of prices set by the state should be decreased. Market regulation should be introduced in all areas where market forces still 'under-perform' due to natural monopolies or other operational privileges.

Environmental impacts

Air pollution caused by transport, primarily by public road transport, constitutes one of the largest environmental problems of the world. In developed countries air pollution from transport represents a 40-80 per cent share of total pollution and in Hungary this indicator is between 40 and 60 per cent.

85-99 per cent of total air pollution from transport is caused by public road transport. Relative emissions from Hungarian motor vehicles are way above the EU norms. The composition of the passenger car fleet is still disadvantageous: the proportion of vehicles with two-stroke and four-stroke engines and no catalytic converters, i.e. motor vehicles with high pollution emissions, is still considerably large. 10 per cent of the vehicles in the most obsolete and aged group are responsible for roughly 50 per cent of air pollution. Air pollution from transport is a major environmental and health problem, primarily in the urban areas adjacent to public roads with heavy traffic. The performance-specific pollution from railway transport, in both passenger-kilometre and ton-kilometre terms, is lower than that from public road transport in all aspects. It would therefore be feasible to shift high-volume transit freight shipping from the public roads to railways.

Problems regarding the disposal of waste from transport operations have primarily been resolved but disposal capacity problems may emerge in the future. Although the majority of the

operational waste is recyclable, the vehicles currently in use were designed with no 'vision for recycling'. The complete recycling of these vehicles may not therefore be achieved although parts of them may 're-utilised'. By applying appropriate recycling technologies, asphalt waste arising from road and pavement renovation may be converted into raw material for construction companies. Half of the asphalt waste (approximately 26 thousand ton a year) is utilised by public road operators. However, obsolete equipment is used in the recycling process.

Long-term development trends

The following international trends are prevalent in the infrastructure and service sectors, including transport:

- The globalisation of infrastructure and service networks calls for the intensified integration of national systems into international structures;
- The ratio of state/community ownership in transport companies is gradually decreasing;
- The labour needs of the service sectors are gradually falling whilst the demand for well-educated, high-quality human resources is increasing;
- Capital needs are rising with the increasing level of automation, but a given service (quality level) may be provided at relatively lower costs;
- A structural shift is taking place among the areas within the transport sector: public road and air transport are gaining in significance, while the role of railways and waterways is declining. (These tendencies will vary from country to country depending on the level of economic development in the relevant country).

The above tendencies are fundamentally based on the conditions and trends prevailing in developed countries. Since Hungary is in a less advantageous position, the above international trends are likely to occur in the country with some delay, which has caused us to set more modest goals when formulating the future scenarios.

Scenarios

Our future scenarios are based on a sector snapshot and the major transport development trends prevailing on a national and international level. The future has been defined along three axes (variables): activity, integration and knowledge-intensity. The panel has formulated three of the theoretically possible scenarios in great detail. The scenario entitled 'western-type modernisation' has the objective of integrating the Hungarian transport system into the international structures and catching up with the level of developed countries in the field of transport. The 'Adapting development' scenario sees the country's transport system, as a 'subordinate' part of the international transport/logistics networks, and in the process of becoming peripheral, with the necessary investments and technology developments being delayed, sometimes to a considerable extent. Finally, the 'Green alternative' scenario assumes that a radical shift will occur towards an improved quality of life and more environmentally friendly attitudes and values, also in the transport and other sectors. This trend will lead to a decreased demand for mobility and a favourable change in the division of labour between the different transport sub-sectors. A path

between the two ‘extremes’ would also be favourable and still essentially realistic, namely a scenario aiming at gradual modernisation whilst also using certain elements of the other two scenarios.

Different courses of development for transport have been analysed on the basis of the present situation and the devised scenario. As a first step we defined the start and end points of our foresight. We extrapolated the current trends from the start point and ‘counted down’ from the end point applying the reflexive method. The results provided by the two approaches were subsequently analysed and the decision-making and ramification points defined. We then formulated two basic scenarios. These scenarios, or a combination of the elements thereof, may be used to devise a set of different visions of the future.

On the basis of the chosen scenario and the possible courses of development, the panel has formulated comprehensive recommendations for the advancement of the country’s transport sector.

Description of the transport scenarios

The scenarios have been developed along three variables. These variables are the same as the ones used for devising the macro-visions, namely: /1/ activity (efforts and endeavours by the state, business and civil communities); /2/ integration (forms and extent of joining the international division of labour); /3/ knowledge-intensity (quality and level of knowledge and technologies used in the country). Knowledge-intensity does not only comprise the improved knowledge level of the sector (e.g. employees with a better education and improved skills and services with higher value-added), but also incorporates the attitudes and values of the persons involved in passenger or freight transport.

The panel formulated the following qualitatively different scenarios in detail:

Scenario 1: ‘Western-type modernisation’

The following macro-economic and social conditions provide the cornerstone for the western-type modernisation of the Hungarian transport system:

- A clear government strategy that encourages both the private and civil sectors to play an active role in the economic and social development of the country;
- Well-timed and tough measures to aid our integration into the EU with a parallel readiness for the country’s accession on the part of the EU,
- A highly knowledge-intensive development course leading to a shift in technology that is supported by both increased R&D resources and social acceptance.

In addition to the above domestic conditions it is also assumed that the international political and economic conditions remain favourable in terms of the willingness to cooperate. The accession of the neighbouring countries to the European Union also aids the integration of the Hungarian transport system into the international structures.

The main characteristic of the western-type modernisation scenario (development course) is that our transport system becomes an integral part of the European logistics/haulage networks. The increase in mobility remains manageable. The direct regulatory role of the state becomes weaker, with a parallel increase in the involvement of the government sector in areas such as freight haulage as a public service, integrated regional development and transport organisation. The transport infrastructure becomes connected to the European networks, meeting western European norms on a qualitative and quantitative basis. The differences between the regions of the country are lessened by the concerted regional development and transport organisation/management measures to upgrade and expand the transport infrastructure. The concentration of capital results in company mergers in the area of freight delivery (shipping) by public roads. A structural shift occurs in railway transport. (The operations of railway maintenance and the commercial operations are organised in separate units which is also true for the freight and passenger transport operations within the latter unit). The infrastructure of the inland waterways remains in state ownership whilst the river ports become either foreign-owned or jointly owned by the state and international investors. Municipalities and private sources finance the development of urban and suburban public transport systems. In addition to increasing profitability, the technological upgrades also have the aim of protecting the environment and improving the quality of life. Information technology and remote technologies and equipment become widely used in all areas of the transport sector. The division of labour within the sector is characterised by the achievement of the optimum level of operation under the conditions of a demand-driven market.

Scenario 2: 'Adapting development'

The major macro-economic characteristics of this scenario are the following:

- Government measures are primarily aimed at managing pressing economic problems or serving the interests of economic interest groups. The primary stimulators of economic development are the multinational companies; the state withdraws from financing economic development projects and is also unable to engage the private sector in these activities;
- A passive government policy leads to a delayed integration with the EU; our position in the international division of labour weakens; the country is characterised by low value-added manufacturing and service activities and we are even unable to realise the opportunities provided by international institutions. As a result the gap between Hungary and the developed countries widens.
- Due to the low or at best medium level of knowledge-intensity, a decline in the demand for and acceptance of new technologies is apparent in the country's economy. Medium level technologies become characteristic of the country and our competitiveness therefore diminishes considerably.

Accession to the EU is delayed. When it is achieved it occurs at far less favourable conditions for us than expected. The external conditions are generally stable as far as foreign policy and economic relations are concerned, but some minor problems may occur. The delayed EU integration on the part of the neighbouring countries means that Hungary's transport system primarily functions as an 'end-point' (of the European networks) for a long period.

This scenario sees all the areas of the Hungarian transport system becoming peripheral in the European networks, playing mainly a 'supporting' role. The increase in mobility leads to pressing problems that are difficult to manage. (The constraining effects of value changes and telematics technologies have limited or no effects at all. The condition of the transport infrastructure is also unsatisfactory and the composition of the vehicle fleet is unfavourable). The passive government strategy preserves the disharmony between transport performance and economic development in the country. Innovation is limited to adopting advanced technologies (mainly in information technology) while the role of indigenous R&D is marginal. The education level of human resources is well behind that described in Scenario 1. The development of the infrastructure remains a low priority and its advancement proceeds along a slow route that is primarily limited to the construction of the public roads and railways forming part of the European transit lines. The state budget, in some cases involving foreign aid or loans, remains the main source for financing developments in the transport system whilst private capital plays an insignificant role. In the labour division of different transport sub-sectors the performance of public road freight haulage and passenger transport increases, which may be partially attributed to profitability and higher flexibility; however, it is also a result of the inability of other sectors to offer real alternatives. The above trends lead to considerable disadvantages including jammed public roads and increased environmental pollution. The lack of government measures and delayed decisions lead to a widening gap between Hungary and the developed world.

Scenario 3: 'Green alternative'

The macro-economic future vision of the 'Green alternative' scenario would only appear to be realisable in 2-3 generations. It envisions a development path that may appear somewhat utopian today and is characterised by the following features:

- An active government strategy in accordance with the new world-wide development trends leads to the establishment of a new, 'green' socio-economic system;
- Integration (with the European Union) is a high priority; nevertheless, support for new, regional integration efforts becomes the focus of measures and activities;
- The country advances along a highly knowledge-intensive development course founded on good education, strong cultural values, increased R&D expenditure and human knowledge and skills. Environmentally friendly technologies and methods receive high priority in the economy and society.

The prevalence of 'green' values in developed countries constitutes an external condition for the realisation of this scenario.

The ‘Green alternative’ scenario sees the domestic transport system becoming connected to the international networks mainly through the transit lines. The domestic system becomes an integral part of the international structures. Mobility decreases radically. Alongside profitability, community and environmental interests become increasingly significant. Regulations conforming to EU standards - through taxes and legal means - are aimed at creating and implementing a tariff system that also includes external factors (e.g. the ‘polluter pays’ principle). The transport system endeavours to introduce and employ the most advanced technologies. With regard to transport planning, bio-regions receive special attention alongside the efforts to meet international regulations and norms. Providing efficient transport services in these regions and developing a territorially balanced, advanced transport infrastructure in the country are high priorities. The development of the domestic transport system is financed primarily from state/community sources and international and private resources are involved mainly in the development of transit lines. Amongst the different areas of the transport sector the railways, waterways and combined transport are a particular priority. Public transport becomes dominant as individual transport declines (due to environmental awareness and changes in values).

The most favourable scenario that may be realised

The ‘Green alternative’ scenario, one of the three future visions described in brief above, is fundamentally built on significant domestic financial resources, human capital and high knowledge-intensity. It is unlikely that the international conditions necessary for its implementation will be created in the next 15-20 years. The social costs involved in the realisation of this scenario would be enormous and are not available in Hungary anyway. The ‘western-type modernisation’ scenario assumes that the advancement of the transport system will proceed more rapidly than the development (growth) of the economy. (This fact itself would not constitute a problem in the event of a rational and cautious advancement). Nevertheless, this alternative is too idealistic and does not take full account of the level of economic development and conditions of the country. In addition the ‘Adopting development’ described in Scenario 2 offers a course of advancement that makes it impossible to keep up with the developed countries, thus maintaining Hungary’s peripheral position in the world.

If one takes account of the present level of the country’s economic development, current government policies and the current condition of the Hungarian transport system, the most favourable scenario that may be realised is a combination of the three scenarios described above. In this combined future vision those contained in Scenario 1 are predominant, with characteristics of the other two scenarios having a lesser significance.

The scenario most favoured and feasible assumes the presence of an active government transport development strategy, strong pro-integration forces in the country and increasing knowledge-intensity in the economy. By implementing an active government strategy, Hungary may not only become a ‘service-providing’ element for the transit traffic of the European shipping and logistics system, but may also become an integral part of the international network by 2020. The mobility growth rate remains within manageable limits. As part of the process of integration with the EU,

the main domestic transport lines located along the Trans-European Network corridor meet international standards in both qualitative and quantitative terms. The same applies to the transport lines connecting major economic and logistics centres within the country, and the infrastructure of underdeveloped regions is also improved. In railway transport the proportion of high-speed, electrified tracks does not reach the level of the western European countries by 2020 but it shows considerable improvement therefore narrowing the gap between Hungary and the developed countries to a significant degree. Developments in technology, technology transfer and the widespread application of advanced technologies lead to a considerable drop in environmental pollution by motor vehicles. By the end of the scenario's time-scale the fair conditions of market competition will have been created through active government policies and other measures and market forces will drive the economy. Government involvement is limited to aspects of freight haulage (shipping) considered as the provision of a public service, the finance of large investments and the planning, organisation and management of integrated transport.

The increase in competition leads to the following structural changes in the transport market:

- In public road transport the impact of market selection leads to a predominance of companies which are strong in capital;
- Railway maintenance and commercial operations are organised in separate units; large government subsidies cease; railway companies other than MÁV also use the state-owned railway tracks,
- Inland water transport essentially plays a supporting role; the infrastructure and most large river ports remain in state ownership, while the vehicle fleet is privatised;
- The infrastructure of air transport remains in state ownership; Hungarian Airlines operate as part of a multinational company;
- The urban and suburban public transport systems are operated by municipalities with the involvement of private capital.

Road usage fees (tolls) constitute an important financial source in the maintenance and operation of the transport infrastructure. These fees are accepted by society, are based on consensus and reflect the level of service quality. The main objectives of the development of transport technology are to increase profitability and transport safety, to protect the environment and to improve the quality of life. Information and telematics technologies become increasingly significant for transport systems. The increase in information technology in transport planning and traffic control leads to decreasing traffic jams and shorter access (travel) times. The installation of information technology systems on HGVs (communication equipment, global positioning systems etc.) aids the improvement of their exploitation ratio whilst also increasing traffic safety. The partial modernisation of the vehicle fleet in public road transport is achieved with active government involvement (financial supports, tax breaks, etc.).

Public road transportation maintains its dominant role over the other areas of the transport sector. Further to a restructuring of railway transportation (modernisation of fast speed train lines), the competitiveness of railway transportation increases. The role of inland water transport remains insignificant in freight shipping. Even though the navigability of waterways is fully reinstated,

the share of water transport is not expected to reach 10 per cent of the total transport performance by 2020. International passenger air traffic increases, its volume approaching close to 8 million persons a year, with a potential increase in the volume of air cargo. The development of information technologies and logistics centres is accompanied by an increase in combined transportation methods although their role remains insignificant for a long period for reasons of profitability. The railways increase their role in urban and suburban passenger transport. The growth rate of individual transport may be decelerated by improving the quality of public transport. This may be achieved through better harmonisation of the aspects and interests of urban and transport development planning as well as their implementation. This process is accompanied by a shift in the value system due to increased social awareness and knowledge-intensity, which in turn leads to the increased role of community values and favourable changes in transport ethics.

Recommendations

Our conclusions and recommendations were formulated on the basis of the deficiencies described in the snapshot analysis, the goals defined in the chosen scenario and the findings of the assessment of the different development courses including the associated 'crossroads' and decision-making points.

1. The main development directions of the transport system

The development of our transport system involves two challenges: on the one hand we have to undertake a qualitative and quantitative improvement of the transit lines (mainly along the Trans-European Network corridors) that provide connections to the main international transport structures. On the other hand we have to pay attention to improving the transport networks between and within the country's regions. The following tasks should be achieved in the different areas of the transport sector:

- Special attention should be paid to developing the network of high-speed public roads, especially with regard to increasing their carrying capacity and improving the public road accessibility of 'isolated' regions and remote areas. In addition, congestion on the public road nodes (junctions) caused by heavy traffic should be removed by building new, relief road capacities.
- Inter-city railway capacities should be strengthened along the main transport lines, with a particular focus on preparing them to meet the requirements of combined transport. Auxiliary lines that carry low traffic and are non-profitable need to be evaluated and necessary measures should be taken on the basis of the findings.
- Due to the bottleneck in the domestic transport system caused by the insufficient number of bridges over the Danube, new bridges should be constructed to increase the crossing capacities of public roads and railways.
- In water transport the main priority should be to achieve navigability of the Danube as soon as possible. The quantitative development of river ports should be based on real demand; emphasis should be placed on enabling the existing ports to provide higher quality services, based on the principle of inter-modality.

- In air transport the need for capacity increases arising from traffic growth only occur in the long term. The development of regional airports should be based on carefully prepared feasibility studies.
- The establishment of three or four larger logistics centres serving the needs of the respective region appears to be justified, with a few smaller ones also being built in main regional trade centres. In larger cities so-called city logistics systems should be introduced. The creation of an infrastructure that meets the increasing needs and demands requires active involvement on the part of the state and municipalities.

It is essential to achieve a professional and political consensus (reinforced by laws, for example) in order to secure stable and predictable conditions for long-term planning and the implementation of infrastructure development programmes which will guarantee the continuity of long-term programmes over several election cycles.

2. The financing of transport infrastructure development

The funding of the domestic transport infrastructure development should primarily come from public resources in the short term due to the low level of solvent demand. EU resources may be used along with state support to develop the elements of the infrastructure constituting transit parts of the pan-European corridors. Development programmes of national priority should be financed mainly from state sources and, to a lesser degree, from the EU structural funds.

The government should allocate 1.5-2.0 per cent of GDP to infrastructure development programmes in the long term, which constitutes a basic pre-requisite for securing sufficient funding to achieve the set goals. However, in the long run it may be necessary to undergo a gradual shift towards to public-private partnership forms of financing. The selection of development projects should be based on aspects of financial and economic feasibility and careful consideration of the relevant risks.

The allocation of financial resources to the national goals of transport network development should be co-ordinated at government level. Municipality and private initiatives should play a greater role in the formulation of goals and the implementation of projects in local transport network development. A project review system conforming to EU standards should be formulated and applied in order to achieve the most efficient use of the limited resources. Development project proposals should be assessed comprehensively using a set of criteria that considers the quality of life and environmental and regional development aspects along with economic interests

3. The maintenance and operation of the transport system

The continuous maintenance of the transport network also deserves special attention alongside its development. The government holds responsibility for maintaining the infrastructure of the state-owned networks but the users essentially pay for the occurring costs. This gives rise to the following:

- A part of the budgetary reforms should comprise an earmarked fund established from the taxes paid by motor vehicle users, which should be used for maintaining public roads. Accordingly, electronic systems enabling the measurement of road usage and toll payment should also be introduced in the long term. These technologies are already available, although a more detailed assessment has to be carried out with regard to public acceptance and the economic risk aspects. In order to achieve public acceptance of road usage fees (tolls) it is essential to decrease fuel taxes, which currently also include a so-called 'road usage' tax.
- In railway transport the separation of the infrastructure and commercial operations should be completed and gradual moves towards securing access to railway tracks for other users should also be made. The imposition of track usage fees should essentially cover the maintenance of the railway infrastructure
- The maintenance costs of the river ports should unquestionably be covered by the fees paid by the service users.

Along with the direct costs, the so-called external costs should also be taken into account when determining the usage fees as this would properly reflect the total social costs of transport. A strategy should be formulated to bridge the gap between the low solvent demand of the domestic market and the increasing transport tariffs (which gradually incorporate external costs). The temporary introduction of so-called 'shadow fees' is advised for non-business road usage, with the difference between the discount and real prices being covered by the budget. Awareness-raising measures should be undertaken to achieve acceptance of the usage fees by society. The transition to the new system may only realistically be achieved in 10-15 years.

4. Increasing efficiency and competitiveness of the transport system/companies

The domestic transport companies will have to undergo profound changes in the years to come:

- With the increasing strictness of international norms, company mergers (concentration) in domestic public road transport seem inevitable. Large domestic transport companies with a high capital volume may be established by forming first professional then strategic alliances. These large companies should be able to compete successfully on the globalising public road transport market. The consistent enforcement of the regulations defining the conditions and rules of market activities is essential to achieve this goal.
- With regard to railway transport, emphasis should be placed on increasing market orientation (separation of infrastructure and commercial operations, securing 'open' access to tracks and adequate marketing). Very good market opportunities are likely to occur in inter-city passenger services and combined transport.
- The companies in the water transport sector may only undergo selective development justified by needs and demands.[5] The permanent navigability of inland waterways

[5] In the long run, the majority of water transport services in the country are likely to be operated by international companies

remains a state responsibility (even if this activity causes a deficit; the concept should also be re-examined every five years).

- In air transport, identifying a strong strategic partner for the national airways company is of the utmost importance, along with the implementation of company integration.

Establishing logistics centres that operate high value-added transport and distribution services may represent an opportunity for the Hungarian economy to strike out on a new path. Bearing this in mind, the government should support targeted projects to develop the external infrastructure of major logistics centres, with the services being operated by private capital on a market basis.

The government's role should be clearly defined in terms of formulating and enforcing regulations, its involvement in the area of public services and in the development of infrastructure programmes of a national interest, etc.). However, the transport companies should be operated according to market conditions. Market principles of operation and management should also be introduced into companies that remain in state ownership in the long term (e.g. railway companies).

5. Aiding the adaptation of advanced technologies in transport

The quantitative and qualitative improvement of the motor vehicle fleet is a key element in the modernisation of the transport system of the country. The following tasks should be accomplished:

- The increase of motor vehicles incorporating advanced and environmentally friendly technologies should be encouraged. To this end, the purchase of such vehicles should be supported (primarily by tax and duty breaks) and the operation of obsolete and polluting vehicle types should also be limited through legal regulations (e.g. taking severe measures in the issuance of vehicle operation licences).
- The liquidation of superfluous capacities is essential, along with the restructuring of the vehicle fleet in accordance with market demand. Due to the enormous amount of financial resources involved, the vehicle fleet may only be modernised on a gradual basis. Attention should therefore also be paid to the renovation and maintenance of the existing vehicle stock as well as the purchase of new vehicle types. The costs may be primarily financed from state resources, but EU support may also play a role here.

Information technology will play an increasing role in the future. It plays a major part in increasing efficiency and reliability and widespread use of information technology in transport systems should be supported and encouraged by the state (e.g. through tax and duty breaks).

6. Managing mobility

The decrease in the growth rate of mobility may be achieved in the long term through regulation. The increase in information technology, advanced logistic centres/methods and alternative transport forms will play a key role in this process, along with changes in the system of values. The raising of public awareness on the challenges and possible responses to these should influence transport needs and provide alternatives in transport service supply. The application of restrictive measures should be limited in their scope.

Bringing about a change in values is a long-term process that takes time to achieve in any situation, including the transport sector. It is therefore essential to aid this process and launch new initiatives encouraging the changes as soon as possible. The key factors and methods of achieving the above include education (knowledge relating to transport and its socio-economic and environmental impacts should be introduced into curricula at a very early stage of education), the media and the 'awareness-raising' work of community organisations.